

THE HONG KONG GALEOMMATACEA (MOLLUSCA: BIVALVIA) AND THEIR HOSTS, WITH DESCRIPTIONS OF NEW SPECIES

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Abstract

Twenty-two species of galeommatacean bivalves from four families and nine genera are described, compared and illustrated. The invertebrate hosts of many of these commensal species are reported for the first time. Six new species are described, belonging to the genera *Pseudopythina* (4), *Barrimysia* (1) and *Scintillona* (1). Of the known species, eleven have been recorded previously from Japan, two from the Philippines, *Ehippondonta oedipus* only from Hong Kong and *Lasaea rubra* from shores virtually world-wide. The generic and familial placement of many of the species discussed are revised.

Introduction

The Galeommatacea Gray, 1840, has been widely studied since the mid-nineteenth century and comprises an extraordinarily diverse group of small species of often uncertain affinity. Many are commensal, and numerous publications have drawn attention to their often intimate relationships with invertebrate hosts (for a review, see Boss 1965). In the last 50 years, many works have documented the biology, functional morphology, and ecology of selected species (Popham 1940; Oldfield 1955; 1961; 1964; Gage 1966; 1968a; Ponder 1967; 1971a; b; Morton 1972; 1973; 1980; 1981; Ockelmann and Muus 1978; O'Foighil 1985; 1987; 1988; O'Foighil and Gibson 1984; O'Foighil and Eernisse 1987; 1988) and exposed a diversity of, often remarkable, adaptations that suit them to their exotic life-styles. In addition to strange morphological adaptations, notable among which is a trend towards reduction of the shell and reflection of the mantle, particularly in the Galeommatidae (Morton 1973; 1975), the commensal life mode has been achieved by reproductive specialization, e.g., sperm storage (O'Foighil 1985), consecutive and simultaneous hermaphroditism (Gage 1968b;

O'Foighil 1987), sexual dimorphism (Jenner and McCrary 1968), and even dwarf males (Morton 1976; 1981).

In spite of the large volume of literature on their biology, the systematics and taxonomy of the Galeommatacea have been in constant confusion. There has been little agreement even as to the correct superfamilial name, with Galeommatacea Gray, 1840 (Ockelmann and Muus 1978; Habe 1981; Bernard 1983; O'Foighil and Gibson 1984), Leptonacea Gray, 1847 (Chavan 1969; Ponder 1971a; b; Boss 1982), and Erycinacea Fischer, 1887 (Boss 1965) seemingly being used interchangeably. The 'Principle of Priority' (Article 23a) in the International Code of Zoological Nomenclature (Ride *et al.* 1985) clearly states the oldest available name should be used, thus Galeommatacea is the correct superfamily name. Many species have been described without the benefit of observations upon living animals or knowledge of their hosts. Morphological specialization has led to a profusion of generic and species names with little understanding of their inter-relationships.

The Galeommatacea are well known in Japan (Habe 1977; 1981), with over 50 species described from the region, several of which have docu-

mented hosts, e.g., *Nipponomontacuta actinariophila* on *Halcampella maxima* (Yamamoto and Habe 1961), *Fronsella ohshimai* and *Nipponomysella subtruncata* on *Sipunculus nudus* (Habe 1964; 1981), *Entovalva semperi* on *Protankrya bidentata* (Ohshima 1931), *Scintillona stigmatica* on *Brissus latecarinatus* (Habe 1981) and *Sagamiscintilla thalassemicola* with *Thalassema mucosum* (Habe 1962; 1981). Xu (1986) recorded six species of galeommataceans from Jiaozhou Bay (Yellow Sea, People's Republic of China) including the commensal relationship between *E. semperi* and *P. bidentata*. In contrast, there is a paucity of taxonomic literature from other South-East Asian localities. Lim (1970) listed one *Galeomma* and three species of *Scintilla* in his checklist of Singaporean molluscs. Only two species of *Scintilla* were identified in an extensive survey of the molluscs of West Malaysia and Singapore (Morris and Purchon 1981). Twenty species of Galeommatidae and one species of *Mysella* were reported from Thailand by Nielson (1976), but they were not determined to species level. A *Mysella* sp. was, however, documented as being attached to the sipunculan *Siphonosoma cumanense*. Tantanasiriwong (1979) documents two species of *Galeomma* and one species of *Scintilla* collected from the 'underside of corals' around Phuket, Thailand. Habe and Kanazawa (1981) describe *Fronsella philippinensis* as commensal with *Sipunculus nudus* from the Philippines. Deshayes (1856a; b; c) reported on the galeommatacean fauna of the Philippines, and described 45 new species of *Galeomma*, *Scintilla*, and *Erycina* from the region. Morton (1972; 1973; 1975; 1976; 1980) reported on *Pseudopythina subsinuata*, *Galeomma takii*, *G. polita*, *Ehippondonta oedipus*, *Montacutona compacta*, and *M. olivacea* from Hong Kong. Additional species (herein described as new) are documented in Hong Kong living with *Sipunculus nudus* and *Siphonosoma cumanense* (Manning and Morton 1987) and associated with coral galleries (Dudgeon and Morton 1982; Morton *et al.* in prep.).

With this paper we have attempted to describe and compare the galeommataceans of a limited geographic area, from intertidal depths to 25 m.

Our goal is to provide a useful regional guide to the fauna, and thus have avoided the many complex higher level taxonomic problems that would require world-wide revisions. For most species, a host or associative fauna has been identified. Knowledge of the host has allowed us to be more assured of species identification and more aware of intra-specific variation. We have found, for example, large variations in the shell morphology of a new species of *Pseudopythina* from the burrow of a single host (*Sipunculus nudus*), as well as variation between sites, similar to the variation reported for *Mysella bidentata* by Ockelmann and Muus (1978). Our hope is that this work on the Hong Kong species will encourage investigators to document galeommatacean taxonomy and host relationships in other regions of South-East Asia.

Format and abbreviations

In the following systematic treatment, each taxon is followed by a synonymy, type specimen data and type locality, a short diagnosis and comparison, notes on habitat, host, distribution and associated remarks. The synonymies are arranged in chronological order, with brackets after an entry indicating a change in generic allocation. New taxa described in this paper are highlighted in boldface. Host, habitat and distributional data are based on personal observations in Hong Kong unless otherwise noted. The authors have examined all type specimens referred to in the text. Each species has been illustrated with either the holotype (new species) or typical specimens (of established species) from the Hong Kong region. All taxonomic citations for the Galeommatacea are listed in the bibliography. Citations for non-galeommatacean host taxa, however, are not included.

The following abbreviations for institutional collections are used in the text.

AMS	Australian Museum, Sydney
ANSP	Academy of Natural Sciences, Philadelphia
BMNH	British Museum (Natural History)
NSMT	National Science Museum, Tokyo

RBCM	Royal British Columbia Museum, Victoria, Canada
SBMNH	Santa Barbara Museum of Natural History
UMUT	University Museum of the Univer- sity of Tokyo
USNM	United States National Museum of Natural History

Systematic Account

Superfamily GALEOMMATACEA Gray, 1840

Family Lasaeidae Gray, 1847

Genus *Lasaea* Brown, 1827

Type species (monotypy):

Cardium rubrum Montagu, 1803

Shell to 6 mm in length, inflated; inequilateral, longer anteriorly; beaks prominent; hinge with two anterior cardinal teeth and a posterior lateral tooth in each valve, ligament transverse.

Lasaea rubra (Montagu, 1803)

(Plate Ia; Figures 1, 2)

Cardium rubrum Montagu, 1803
Montagu 1803: 83-84

For commentary on additional synonyms see remarks below.

Type. Not located, possibly not extant.

Diagnosis. Shell broadly ovate, deep reddish-brown; beaks prominent and broad; prodissoconch of Hong Kong specimens large, 0.5 mm; periostracum heavy and roughened; sculpture of fine concentric lines; hinge variable, with minute to prominent cardinal and lateral teeth; anterior cardinal teeth dark red.

Comparison. This species is differentiated from the Asian species *Lasaea undulata* (Gould, 1861) (lectotype USNM 1319) which has prominent, broad and widely spaced concentric ribs, and a well developed hinge (see remarks below).

Habitat. Mid to high tidal levels (> + 0.8 m) on sheltered shores throughout Hong Kong.

Host. Nestling among *Brachidontes variabilis* (Krauss, 1848) and *Saccostrea cucullata* (Born, 1778). Specific host unknown.

Distribution. HONG KONG: New Territories, Tolo Harbour, Hoi Sing Wan; possibly a cosmopolitan species.

Remarks. The taxonomy of the genus *Lasaea* is poorly understood. In a study of shell height and length Keen (1938) reported that *L. rubra* was restricted to the North Atlantic. However, Ponder (1971a) concluded that the species has a much wider distribution and is closely related to Pacific species. Recent electrophoretic analyses of *L. rubra* in the North Atlantic (Crisp *et al.* 1983; Crisp and Standen 1988) and of *L. subviridis* (Dall, 1899) in the North Pacific (O'Foighil 1986; 1987) have illustrated the complex reproductive biology of this group. O'Foighil (1986) and O'Foighil and Eernisse (1988) reported reproductively isolated strains of *Lasaea* which could not be consistently correlated with shell shape or colour. In addition, O'Foighil (1988 and personal communication) has found the presence or absence of heavy concentric ribs to be a poor character for separating *Lasaea* species. Until a taxonomic revision of the genus is completed, including electrophoretic and morphometric analyses, the relationships of all species will remain in doubt.

While the type of *Lasaea rubra* was not available, Hong Kong specimens were found to be very close to specimens of *L. rubra* from the Isle of Guernsey in the English Channel (SBMNH 00641).

Family Kelliidae Forbes and Hanley, 1848

Genus *Kellia* Turton, 1822

Type species

(subsequent designation Récluz 1844):

Mya substriata Montagu, 1803

Shell suborbicular, inflated, white to olive; beaks

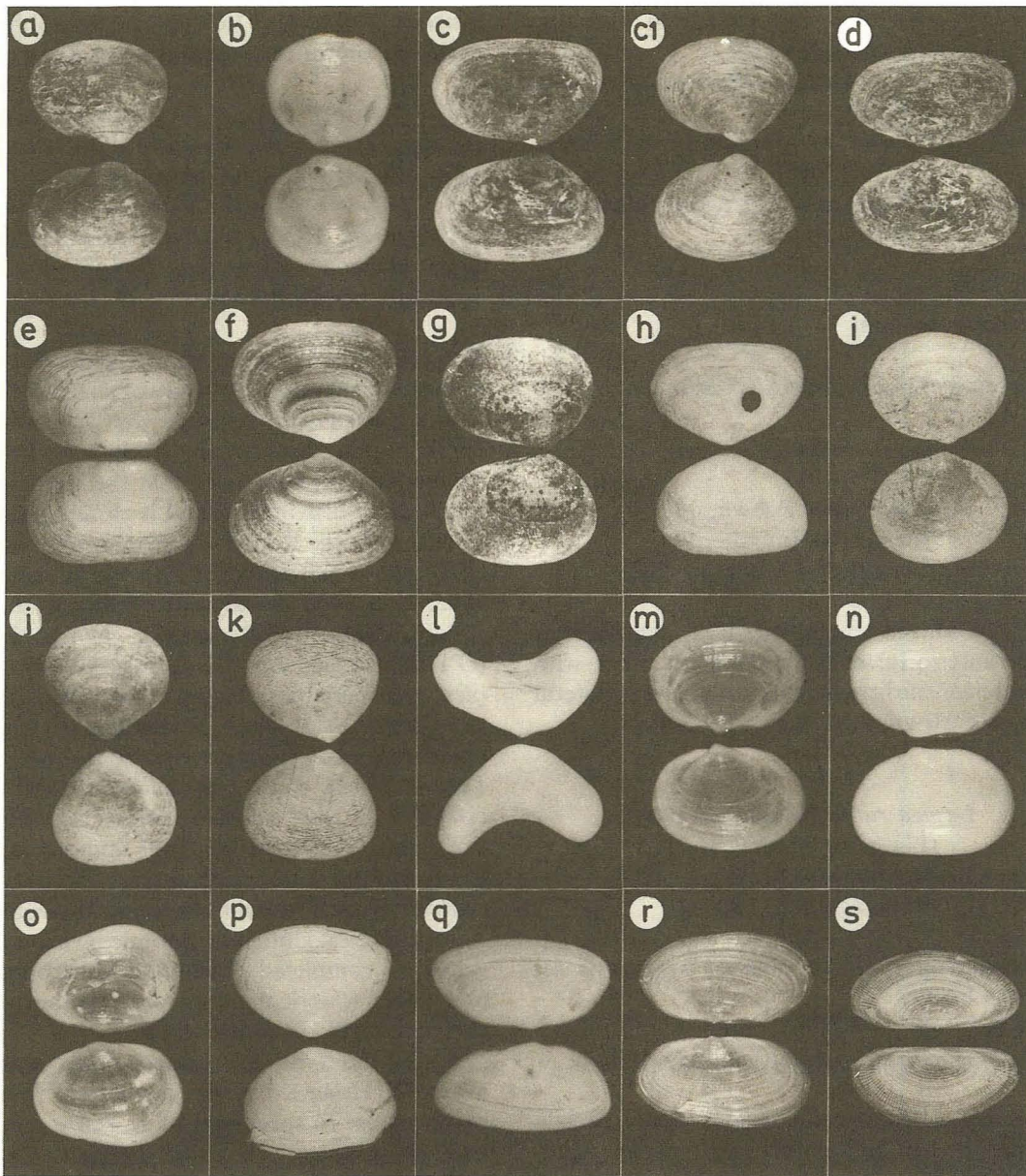


Plate I. External views (measurements are total length) of the shells of: a, *Lasaea rubra* (2.3 mm) (SBMNH 35054); b, *Kellia porculus* (10.7 mm) (SBMNH 35055); c, *Pseudopythina ariakensis* (11.3 mm) (SBMNH 35056); c¹, *P. tsurumaru* juvenile (4.0 mm) (SBMNH 35057); d, *P. ochetostomae* sp. nov., holotype (10.1 mm) (BMNH 1989014); e, *P. nodosa* sp. nov., holotype (6.1 mm) (BMNH 1989013); f, *P. macrophthalmensis* sp. nov., holotype (3.1 mm) (BMNH 1989011); g, *P. maipoensis* sp. nov., holotype (2.6 mm) (BMNH 1989012); h, *Mysella compacta* (7.2 mm) (SBMNH 35058); i, *M. mutsuwanensis* (4.4 mm) (SBMNH 35059); j, *M. triangularis* (3.4 mm) (SBMNH 35060); k, *Barrimysia siphonosomae* sp. nov., holotype (7.2 mm) (BMNH 1989015); l, *Curvemysella paula* (6.1 mm) (SBMNH 35061); m, *Scintilla nitidella* (10.9 mm) (SBMNH 35062); n, *Scintilla* cf. *opalinus* (12.8 mm) (SBMNH 35063); o, *Scintilla* cf. *cuvieri* (8.8 mm) (SBMNH 35064); p, *Scintillona brissae* sp. nov., holotype (5.6 mm) (SBMNH 35074); q, *Galeomma takii* (15.1 mm) (SBMNH 35065); r, *G. polita* (11.9 mm) (SBMNH 35066); s, *Ehippodonta oedipus* (7.4 mm) (SBMNH 35067).

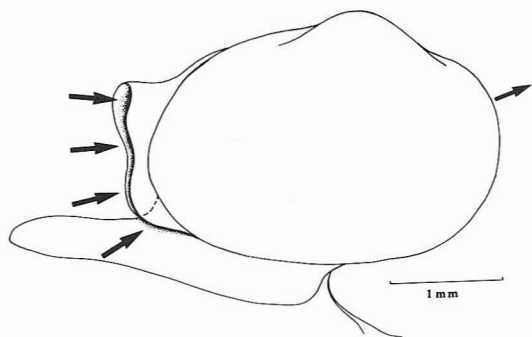


Fig. 1. *Lasaea rubra*. The living animal seen from the left side.

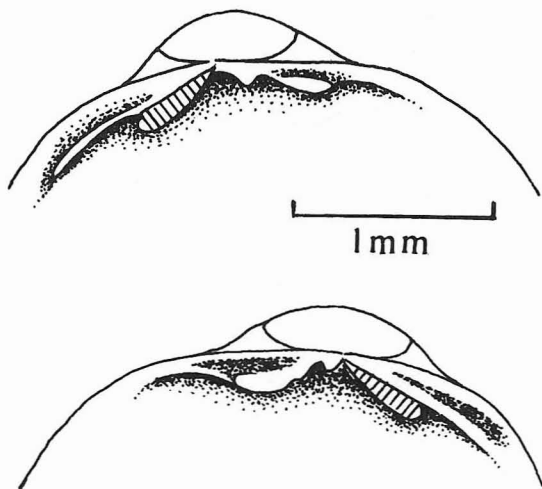


Fig. 2. *Lasaea rubra*. The hinge plate; left above, right below.

prominent, prosogyrate; hinge with two anterior cardinal teeth in left valve, and one anterior cardinal tooth in right valve; posterior lateral tooth in each valve; ligament transverse.

Kellia porculus Pilsbry, 1904
(Plate Ib; Figures 3, 4)

Kellia porculus Pilsbry, 1904
Pilsbry 1904: 558, pl. 41, figs. 18–20
Habe 1968: 184, pl. 57, fig. 6
Habe 1971: 126, pl. 57, fig. 6
Kuroda *et al.* 1971: 405E, pl. 119, figs. 3, 4

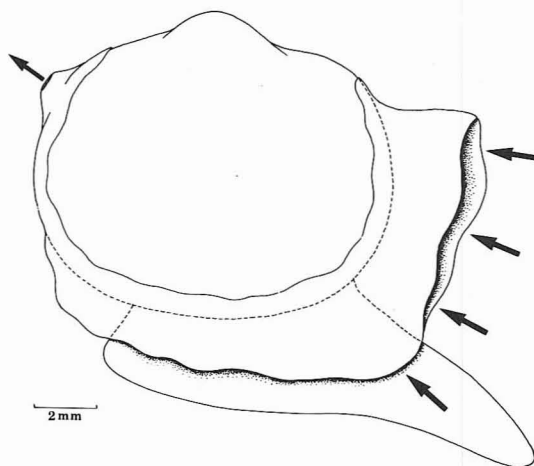


Fig. 3. *Kellia porculus*. The living animal seen from the right side.

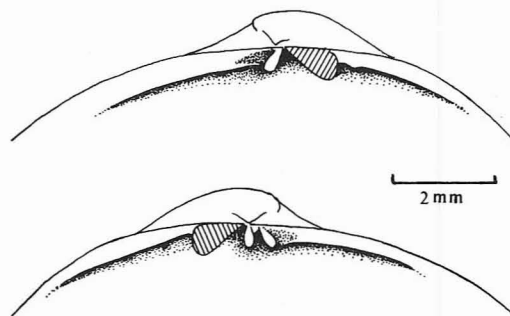


Fig. 4. *Kellia porculus*. The hinge plate; left above, right below.

Habe 1977: 139, pl. 26, figs. 10–12
Habe 1981: 97
Xu 1986: 32

Holotype. ANSP 86266 (1 pair); Hirado, Hizen, Japan.

Diagnosis. Shell to 13 mm in length, white, thick, inflated; equilateral; beaks prominent, prosogyrate; prodissoconch small, 0.3 mm, periostracum thin, clear, highly polished; sculpture of irregular concentric growth lines; posterior margin broadly truncate, ventral margin evenly rounded; anterior teeth stout in both valves.

Comparison. *K. porculus* is similar in shape to *K. japonica* Pilsbry, 1895 (syntypes ANSP 56876), but the former possesses much heavier teeth and a thicker, more inflated shell.

Habitat. Subtidal coral heads and low intertidal rocks.

Host. Occurs in coral galleries (Dudgeon and Morton 1982); also nestling among masses of *Barbatia helbingi* (Bruguere) and *Saccostrea cucullata* at the sublittoral fringe. Specific host, if commensal, unknown.

Distribution. HONG KONG: New Territories, Tolo Harbour, at Wu Kai Sha and Hoi Sing Wan; JAPAN: Honshu, Shikoku, and Kyushu (Habe 1981).

Remarks. All species of *Kellia* are variable in general shape and shell thickness. With further study and more comparative material it is possible that *K. porculus* will be found to be a thickened form of *K. japonica*. In addition, two species from the Philippines, *Kellia macrodonta* (Deshayes, 1856c) (syntype BMNH 196799) and *K. bullula* (Deshayes, 1856c) (syntype BMNH 196794), may be juveniles (and hence senior synonyms) of *K. porculus*.

Large specimens (over 10 mm) of *K. porculus* have been noted with numerous ctenidial broods which are approximately 0.15 mm in length.

Genus *Pseudopythina* Monterosato, 1884,
ex Fischer MS

Type species (original designation):
Kellia macandrewi Fischer, 1867

Shell size and shape variable; beaks prosogyrate; left valve with large anterior cardinal tooth; right valve with smaller anterior tooth, and, often, a minute tubercle just below beaks; weak posterior lateral tooth in both valves, ligament prominent, transverse.

Subgenus *Borniopsis* Habe, 1959
Type species (original designation):
Borniopsis tsurumaru Habe, 1959

Shell with faint external radial striae.

Pseudopythina (Borniopsis) ariakensis
(Habe, 1959)
(Plate 1c; Figure 5A)

Borniopsis ariakensis Habe, 1959
Habe 1959: 293, text figs. 13–15
Habe 1968: 184, pl. 57, fig. 9
Habe 1971: 126, pl. 57, fig. 9
Habe 1977: 142, pl. 26, figs. 19, 20
(see remarks)

Holotype. NSMT 39861 (left valve); Ariake Bay, Kyushu, Japan.

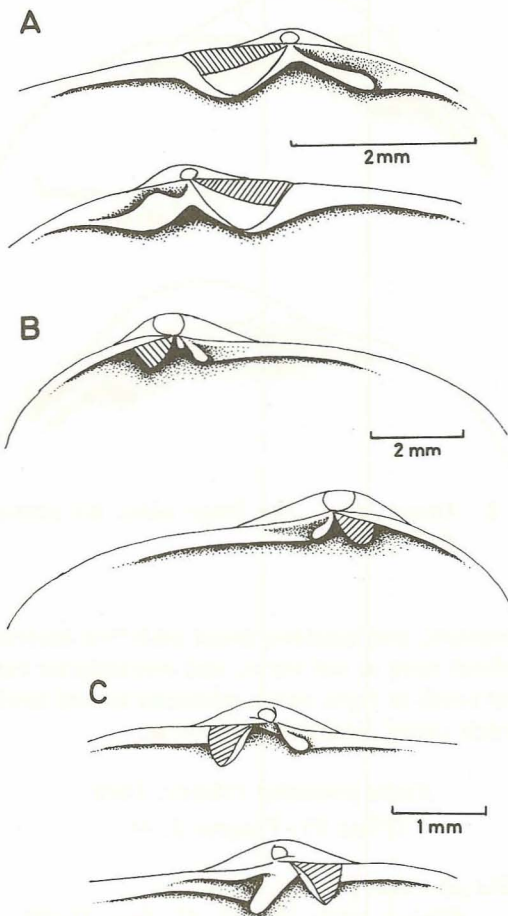


Fig. 5. A, *Pseudopythina (Borniopsis) ariakensis*; B, *P. (Borniopsis) tsurumaru*; C, *P. (Borniopsis) ochetostomae* sp. nov. The hinge plates; left above, right below.

Diagnosis. Shell to 12 mm in length, subtrigonal, moderately inflated; inequilateral, longer anteriorly; beaks small; prodissoconch small, 0.3 mm; sculpture of very fine radial and concentric riblets, and irregular growth checks; antero-dorsal margin straight, gently sloping from beaks; postero-dorsal margin straight, strongly sloping from beaks; anterior margin flared and broadly rounded; cardinal tooth in left valve reduced.

Comparison. This species is similar to *P. tsurumaru* (Habe, 1959) but differs by reduced, narrow beaks, a smaller prodissoconch, and straight dorsal margins on either side of the beaks. Both species differ from other Indo-West Pacific species of *Pseudopythina* by an inequilateral shell which is longer anteriorly.

Habitat. Subtidal muds, about 10 m.

Host. Possibly sharing the burrow of *Protankyra bidentata* (Woodward and Barrett) (Holothuroidea) with *Hexapus anfractus* Rathbun, 1909 (Decapoda), *Lepidasthenia ohshimai* Okuda, 1936 (Annelida) and *Pseudopythina tsurumaru*.

Distribution. HONG KONG: New Territories, Tap Shek Kok; JAPAN: Kyushu (Habe 1977).

Remarks. Based on examination of the type specimens, the illustrations of *P. ariakensis* and *P. tsurumaru* in Habe 1977, plate 26 are reversed. *P. ariakensis* should be figures 19 and 20, and *P. tsurumaru* should be figures 17 and 18.

Pseudopythina (Borniopsis) tsurumaru
(Habe, 1959)
(Plate I c¹; Figure 5B)

Borniopsis tsurumaru (Habe, 1959)

Habe 1959: 292, text figs. 10–12

Habe 1977: 142, pl. 26, figs. 17, 18 (see remarks above)

Habe 1981: 99

Xu 1986: 32

Holotype. NSMT 39906 (1 pair); Ariake Bay, Kyushu, Japan.

Diagnosis. Shell to 11 mm in length, subelliptical, moderately inflated; inequilateral, longer anteriorly; beaks prominent, broad; prodissoconch large, 0.5 mm; fine radial sculpture on entire shell; heavy, evenly spaced concentric sculpture on juvenile shell when not eroded; dorsal and posterior margins broadly rounded; anterior margin flared and broadly rounded; cardinal teeth robust in both valves.

Comparison. See comparison of *P. ariakensis* above.

Habitat. Subtidal muds, about 10 m.

Host. Possibly sharing the burrow of *Protankyra bidentata* (Holothuroidea) with *Hexapus anfractus* (Decapoda) to which it occasionally attaches, *Lepidasthenia ohshimai* (Annelida) and *Pseudopythina ariakensis*. For details of the commensal relationship of this species see Morton (1988).

Distribution. HONG KONG: New Territories, Tap Shek Kok; JAPAN: Honshu, and Kyushu (Habe 1981).

Pseudopythina (Borniopsis) ochetostomae
Morton and Scott sp. nov.
(Plate Id, Figures 5C, 6)

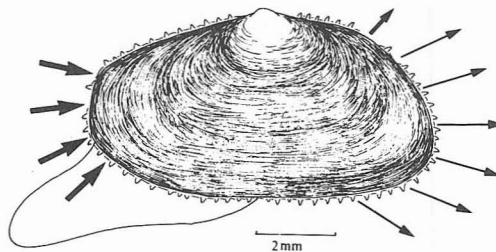


Fig. 6. *Pseudopythina ochetostomae* sp. nov. The living animal as seen from the left side.

Description. Shell to 11 mm length, subtrigonal to subelliptical, moderately compressed; equilateral to slightly longer posteriorly; beaks small, narrow; prodissoconch small, 0.3 mm; irregular, heavy concentric growth checks; periostracum

heavy, tan to dark brown; dorsal margin gently sloping on either side of beaks; anterior and posterior margins equally rounded; cardinal teeth in both valves weak, posterior lateral teeth absent.

Type locality. Hong Kong, New Territories, Tolo Harbour, Ting Kok; 22° 28' 15" N, 114° 12' 45" E; intertidal sandy mud flats in the burrows of *Ochetostoma erythrogrammon* (Echiura); collected by B. Morton and P.H. Scott, 15 October 1987.

Etymology. This species is named after the host echiruan *Ochetostoma erythrogrammon* (Leuckart and Ruppell, 1828).

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	BMNH 1989014	10.1	6.1
Paratype	SBMNH 35068	7.6	4.8
Paratype	NSMT-Mo64700	8.2	5.2
Paratype	USNM 859385	6.5	4.3

(plus unmeasured paratype BMNH 1988004)

Comparison. This species is closest to *Squillaconcha sagamiensis* (Habe, 1961) (holotype NSMT 39872). The latter, however, has a straight ventral margin, straight sloping dorsal margins, and attains a length up to 20 mm. The equilateral shell with a dorsal margin that gently slopes on either side of the beaks, and weak hinge teeth differentiates this from all other species of the genus in the region.

Habitat. Intertidal protected sandy mud flats.

Host. In the burrows of *Ochetostoma erythrogrammon* (Echiura). For details of the commensal relationship of this species (as *Pseudopythina* sp. nov.) see Morton (1988).

Distribution. HONG KONG: New Territories, Tolo Harbour, Ting Kok and Hoi Sing Wan; Hong Kong Island, Tai Tam.

Remarks. The galeommatid *Sagamiscintilla*

thalassemicola (Habe, 1962) (holotype NSMT 39829) was described as living commensally with the echiuran *Thalassema mucosum* Ikeda in Japan. While occupying a similar niche, this species has no conchological similarities to *Pseudopythina ochetostomae*.

Pseudopythina (Borniopsis) **nodosa**
Morton and Scott sp. nov.
(Plates Ie, Iib; Figures 7, 8A)

Description. Shell to 6 mm length, quadrate (juveniles ellipsoid), moderately compressed; inequilateral, much longer anteriorly; beaks prominent; prodissoconch medium, 0.4 mm; sculpture of irregular concentric growth striae, very faint radial striae visible in some specimens; periostracum heavy, light brown, usually only covering perimeter of shell; antero-dorsal margin straight, anterior margin broadly flared and abruptly truncate; posterior margin broadly rounded; ventral margin straight; right valve with a single, large anterior cardinal tooth directly below beaks, projecting to ventral margin; left valve with large anterior and small central cardinal tooth; ligament directed ventrally, seated in a deep resilifer; many small nodules on the inner anterior margin of shell.

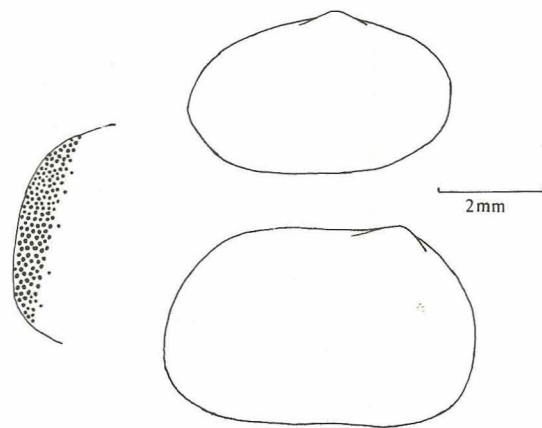


Fig. 7. *Pseudopythina nodosa* sp. nov. The outlines of two growth forms as seen from the left side and (left) details of the inner surface of the anterior valve margin.

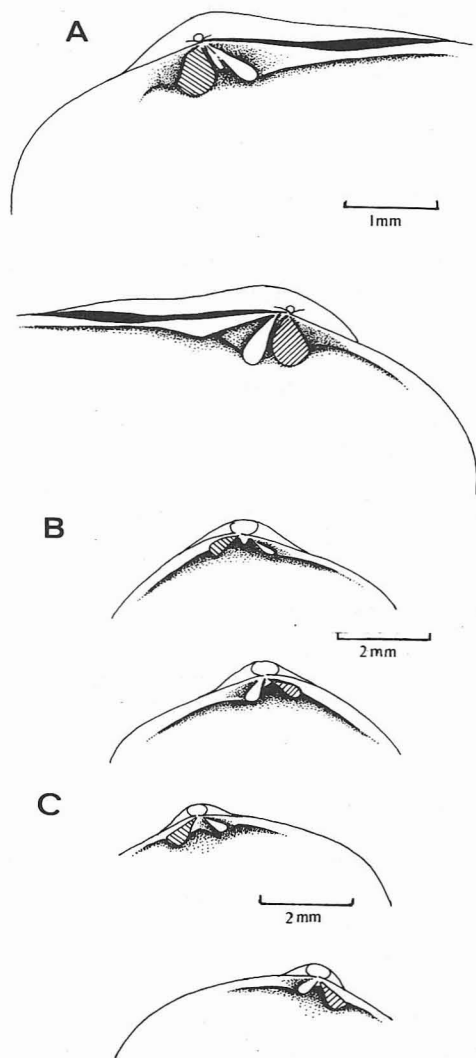


Fig. 8. A, *Pseudopythina nodosa* sp. nov.; B, *P. macrophthalmensis* sp. nov.; C, *P. maipoensis* sp. nov. The hinge plates; left above, right below.

Type locality. Hong Kong, Hong Kong Island, Tai Tam Bay; 22° 15' N, 114° 11' E; intertidal sandy mud flats; attached to *Sipunculus nudus*; collected by B. Morton, 26 August 1980.

Etymology. The specific name is derived from its

distinguishing character, the presence of nodules on the inner anterior margin of the shell (see Figure 7).

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	BMNH 1989013	6.1	3.8
Paratypes	SBMNH 35069	5.3	3.7
		4.6	3.2
Paratype	NSMT-Mo64696	5.6	3.8
Paratype	USNM 859384	5.3	3.6
(plus unmeasured paratype BMNH 1988005)			

Comparison. This species is similar in shape to *Pseudopythina fujitani* (Yokoyama, 1927) (lectotype UMUT CM24045, currently missing from collection). The nodules of the inner anterior margin of juvenile and adult specimens separate *P. nodosa* from all Indo-West Pacific galeommatacids.

Habitat. Intertidal, sandy mud flats.

Host. Attached to the body wall of *Sipunculus nudus* Linnaeus, 1799 (Sipuncula). Manning and Morton (1987) (incorrectly identified as *Fronsella ohshimai*) and Morton (1988) (as *Pseudopythina* sp. nov.) discuss the commensal associations of this species.

Distribution. Known only from the type locality.

Remarks. The shape of *P. nodosa* is variable, with juveniles having rounded anterior margins and adults a truncate anterior margin (Fig. 7).

This species grasps the host, *Sipunculus nudus*, with the anterior portion of the shell. The nodules along the inner anterior margin of the shell probably provide a more suitable surface with which to maintain purchase. Two species of *Fronsella* are reported similarly grasping a sipunculan host. *Fronsella ohshimai* Habe, 1958 (holotype NSMT 49819) (see Habe, 1964, figure 5) lacks the inner nodules, has a pointed and slightly rostrate anterior margin and a single anterior tooth. *Fronsella philippinensis* Habe and Kanazawa, 1981 (holotype NSMT 59497)

(see Habe and Kanazawa, 1981, figures 2 and 3) has well developed lateral teeth in both valves unlike *Pseudopythina nodosa* and *F. ohshimai*.

While Habe (1977) placed *Kellia fujitaniana* Yokoyama, 1927 in the genus *Fronsella*, we find the hinge plate to be identical to *Pseudopythina* and herein place the species in this genus. Members of the genus *Fronsella* have a single, robust, anterior tooth and a well developed resilifer.

Subgenus *Squillaconcha*

Kuroda and Habe in Kuroda *et al.* 1971

Type species (original designation):

Kellia subsinuata Lischke, 1871

Shell with a slightly incurved ventral margin.

Pseudopythina (Squillaconcha) subsinuata
(Lischke, 1871)
(Plate IIa)

Kellia subsinuata Lischke, 1871

Lischke 1871a: 43

Lischke 1871b: 136, pl. 10, figs. 1-3

Habe 1968: 184, pl. 57, fig. 2 [*Pseudopythina*]

Habe 1971: 126, pl. 57, fig. 2 [*Pseudopythina*]

Kuroda *et al.* 1971: 404E, pl. 87, fig. 12 [*Squillaconcha*]

Morton 1972: 79-96, pl. 1, text figs. 1-6, 8 [*Pseudopythina*]

Habe 1977: 139 [*Squillaconcha*]

Habe 1981: 97 [*Squillaconcha*]

Holotype. Not located.

Diagnosis. Shell to 12 mm, subtrigonal, thin, transparent, inflated; equilateral; beaks prominent; ventral margin incurved with a slight byssal notch.

Comparison. The inflated shell and incurved ventral margin separate this from other Indo-West Pacific species. The general shape is similar to that of the eastern Pacific *P. rugifera* (Carpenter, 1864) that is commensal on the crustacean *Upogebia pugetensis* (Dall 1899).

However, *P. rugifera* possesses an inner and outer demibranch (Narchi 1969) whereas *P. subsinuata* has only a single, inner, demibranch (Morton 1972).

Habitat. Intertidal to subtidal, sandy mud.

Host. Attached to the thorax of Stomatopoda, most commonly *Oratosquilla oratorio* (de Haan, 1844). Morton (1972; 1988) discusses the biology, functional morphology, and commensal relationship of this species.

Distribution. HONG KONG: locally trawled in-shore waters; JAPAN: Honshu, Shikoku, and Kyushu (Habe 1981).

Remarks. A specimen of this species and its host is vouchered as SBMNH 35136.

Subgenus uncertain

Pseudopythina macrophthalmensis

Morton and Scott sp. nov.

(Plate If; Figures 8B, 9, 10)

Description. Shell to 3 mm in length, trigonal, highly inflated around beaks, deep reddish-brown; inequilateral, slightly longer anteriorly; beaks prominent, prosogyrate; prodissoconch medium, 0.4 mm; shell smooth except for faint concentric growth striae; periostracum brown, roughened, eroded from beaks; right valve with a single stout cardinal tooth directly below beaks, pointed to the antero-ventral margin; left valve with two cardinals, one very small, pointed ventrally, the other much larger, transversely pointed to the antero-dorsal margin; ligament transverse, pointed to postero-dorsal margin; antero-dorsal margin slopes about 30° leading to a slightly drawn out and evenly rounded anterior margin; postero-dorsal margin with a sharp 45° slope extending to a truncate and sharply rounded posterior margin; ventral margin slightly rounded. Internally, each ctenidium comprises a single demibranch (see Figure 10 for details of the organs of the mantle cavity).

Type locality. Hong Kong, New Territories, Tolo

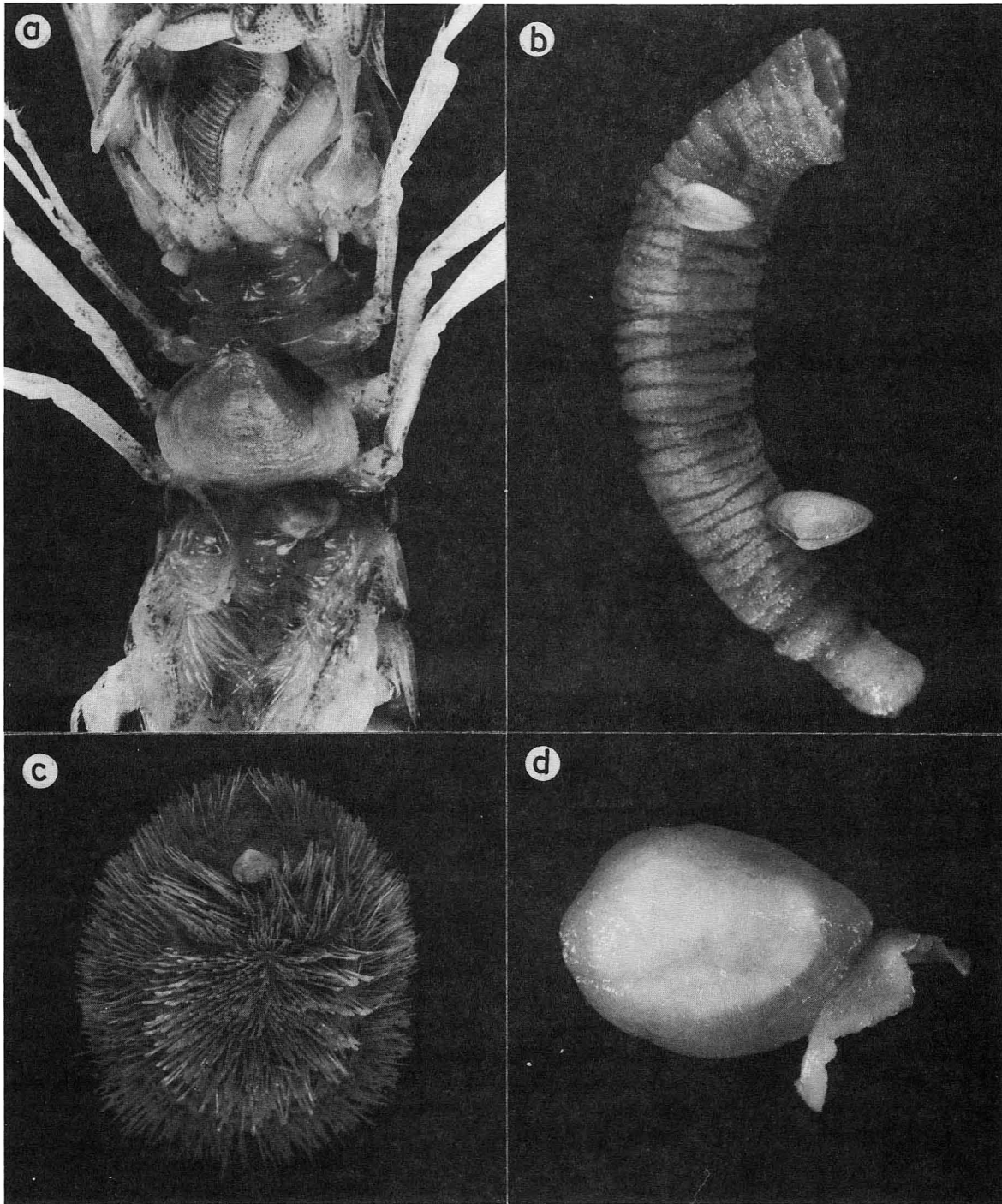


Plate II. a, *Pseudopythina subsinuata* attached to the ventral thorax of *Oratosquilla oratoria*; b, *Pseudopythina nodosa* sp. nov. attached to *Sipunculus nudus*; c, *Scintillona brissae* sp. nov. attached to *Brissus latecarinatus*; d, *Entovalva semperi*, the animal as seen from the right side.

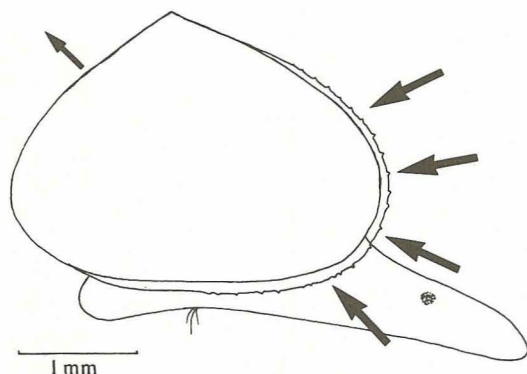


Fig. 9. *Pseudopythina macrophthalmensis* sp. nov. The living animal as seen from the right side.

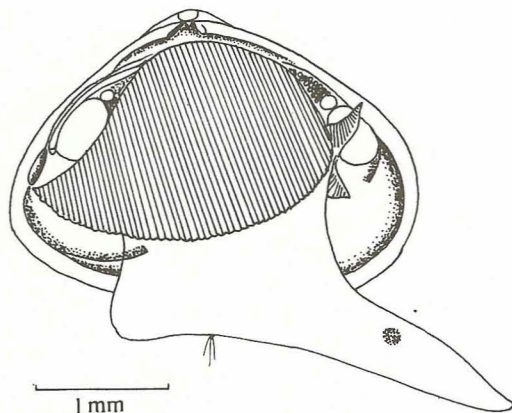


Fig. 10. *Pseudopythina macrophthalmensis* sp. nov. The organs of the mantle cavity as seen from the right side.

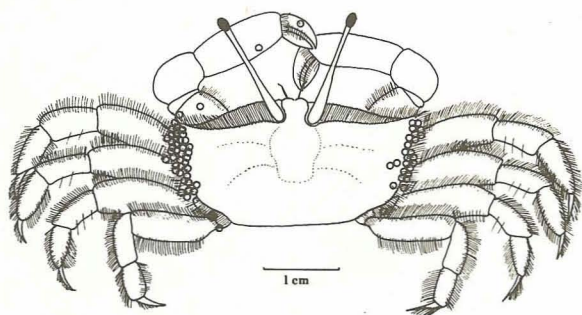


Fig. 11. A dorsal view of *Macrophthalmus latreille* showing positions occupied (o) by specimens of *Pseudopythina macrophthalmensis* sp. nov.

Harbour, Hoi Sing Wan; approximately 22° 26' N, 114° 15' E; intertidal on sandy mud; attached to the decapod *Macrophthalmus latreille*; collected by B. Morton, March 1981.

Etymology. The species is named after the host *Macrophthalmus latreille* (Desmarest, 1817).

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	BMNH 1989011	3.1	2.4
Paratypes	SBMNH 35070	3.2	2.4
		2.9	2.4
		2.9	2.3
Paratypes	NSMT-Mo64694	3.0	2.3
		3.1	2.4
		2.6	1.9
Paratypes	USNM 859382	2.9	2.2
		2.5	1.9
		2.8	2.1
		2.8	2.2

(plus 13 additional unmeasured paratypes, SBMNH 34071 & 34072)

Comparison. The small size, trigonal outline, and deep reddish-brown colour separates this from all other species.

Habitat. Intertidal sandy mud flats.

Host. Attached to the lateral margins of the carapace and appendages of *Macrophthalmus latreille* (Decapoda: Ocypodidae) (Fig. 11).

Distribution. Known only from the type locality.

Remarks. Over 50 specimens were collected on one date, but this species has not been found again. It is possible that the normal distribution is in warmer waters.

Pseudopythina maipoensis
Morton and Scott sp. nov.
(Plate 1g; Figures 8C, 12, 13)

Description. Shell to 3 mm in length, broadly ovate, slightly inflated, white; inequilateral,

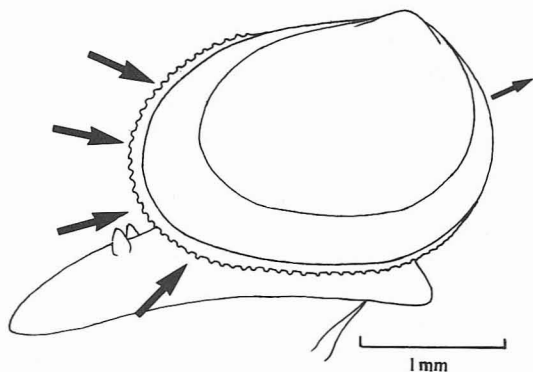


Fig. 12. *Pseudopythina maipoensis* sp. nov. The living animal from the left side.

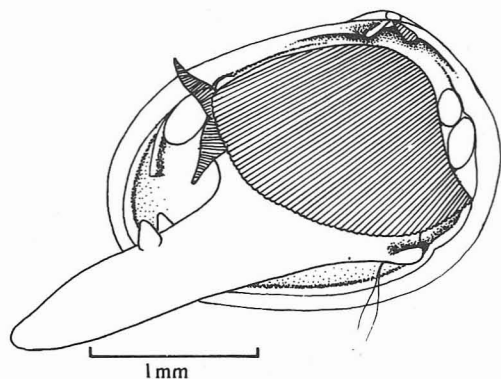


Fig. 13. *Pseudopythina maipoensis* sp. nov. The organs of the mantle cavity as seen from the left side.

longer anteriorly; beaks small, prosogyrate; prodissoconch small, 0.2 mm; sculpture of very fine concentric growth striae, juvenile shell smooth; periostracum cream to tan with brown to black deposits around beaks; right valve with a single small anterior tooth directly below beaks, projecting laterally and directed to the antero-ventral margin; left valve with very small anterior cardinal tooth directly below beaks which fits dorsal of the tooth in the right valve; ligament transverse, pointed toward the postero-ventral margin; an obvious trigonal gap is found between the ligament and the cardinal teeth; antero-dorsal

margin gently sloping to a broadly rounded anterior margin; postero-dorsal margin with a 45° slope leading to a truncate and rounded posterior margin; ventral margin slightly rounded. Internally, each ctenidium comprises a single demibranch; two distinctive papillae on the dorsal surface of foot (see Fig. 13 for details of the organs of the mantle cavity).

Type locality. Hong Kong, New Territories, Mai Po; approximately 22° 30' N, 114° 04' E; in shrimp ponds; collected by S.Y. Lee, 15 October 1987.

Etymology. The species is named after the type locality, the Mai Po Marshes Nature Reserve.

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	BMNH 1989012	2.6	2.0
Paratypes	SBMNH 35126	3.0	2.2
		2.4	1.9
		2.3	1.9
		2.0	1.6
	(plus 3 additional paratypes)		
Paratypes	NSMT-Mo64695	2.5	1.9
		1.9	1.4
Paratype	USNM 859383	2.0	1.6

Comparison. *P. maipoensis* is closest in general shape to adult *P. nodosa*, although the outlines are distinctly different in shells of similar sizes. *P. maipoensis* also lacks the nodules present along the inner anterior margin of shells of *P. nodosa*.

Habitat. Silty clay of artificial, tidally flushed shrimp ponds and tidal mudflats of protected bays.

Host. Unknown, but probably a burrowing tanaid (*Discapseudes* sp.) or polychaete (see remarks).

Distribution. HONG KONG: only known from type locality; PEOPLE'S REPUBLIC OF CHINA: Guangdong Province, Hau Hoi Wan.

Remarks. In laboratory experiments, this species was placed in a dish of native sediments with possible hosts from the Mai Po shrimp ponds. After being placed in the dish, *P. maipoensis* would often quickly turn in the direction of a tanaid burrow and crawl into it. While this gives a strong indication that *P. maipoensis* lives commensally with tanaiids (*Discapseudes* sp.), additional experiments are necessary to assign a host. Tanaiids from the Mai Po shrimp ponds are vouchered as SBMNH 35127.

Pseudopythina maipoensis is fast moving, crawling over the sediment at about 1 cm per minute. The species is a component of the diet of the mudskipper, *Boleophthalmus pectinirostris* (Linnaeus), in Hau Hoi Wan (Deep Bay).

Family Montacutidae Clark, 1855

Genus *Mysella* Angas, 1877

Type species (original designation):

Mysella anomala Angas, 1877

Shell from 3 to 10 mm in length; beaks opisthogyrate; right valve with two diverging cardinal teeth, one anterior and one posterior of the beaks, the posterior tooth may be reduced in some species; left valve edentulous, but with a thickened and projecting dorsal margin which interlocks above the teeth in right valve; ligament small, seated on a resilifer directly below the beaks.

The generic level taxonomy of this group has been confused for over a century. A number of names have been used for these common opisthogyrate montacutids with two cardinal teeth in the right valve and no cardinals in the left. Dall (1900, pp. 1157–59) reviews several available genera, and unfortunately synonymizes *Mysella* with *Rocheportia* Velain, 1877, a name published after Angas (1877). *Mysella* is currently in common use for Atlantic Ocean species (Tebble 1966; Ockelmann and Muss 1978) and Pacific Ocean species of this group (Bernard 1983). We have opted to use this name until world-wide revision of this group is completed.

Subgenus *Montacutona*

Yamamoto and Habe, 1959

Type species (original designation):

Montacutona mutsuwanensis

Yamamoto and Habe, 1959

Ctenidium with an inner demibranch and the descending lamella of the outer demibranch; one cardinal tooth on either side of beaks in right valve.

The hinge of many members of the genera *Mysella* (*sensu lato*) and *Montacutona* are identical. However, *Mysella* has only a single, inner, demibranch (Popham 1940) while *Montacutona* has both inner and outer demibranchs (Ponder 1971b; Morton 1980). As it is impossible to distinguish the two genera without reference to their anatomy, we have retained the use of *Montacutona* as a subgenus of *Mysella*. The subgeneric status of fossil species and species known only from shells will remain unknown until, in the latter case, the anatomy can be studied.

Mysella (*Montacutona*) *compacta* (Gould, 1861)
(Plate 1h; Figure 14A)

Kellia compacta Gould, 1861

Gould 1861: 34

Johnson 1964: 57, pl. 29, fig. 3

Morton 1980: 431–55, pl. 1, fig. a, text
figs. 1–4, 6–14 [*Montacutona*]

Holotype. USNM 24146 (right valve); 'China Seas' (see remarks).

Diagnosis. Shell to 7 mm, thick for genus, sub-trigonal, length greater than height, moderately inflated; equilateral; beaks wide, prominent, opisthogyrate; prodissoconch medium, 0.4 mm; sculpture of irregular, thick growth rings; periostracum tan; ventral margin nearly straight; teeth in right valve of equal size, small to very robust; lithodesma thick, butterfly shaped.

Comparison. The thickened, equilateral shell, prosogyrate beaks, and straight ventral margin easily differentiate this species from all other members of the genus.

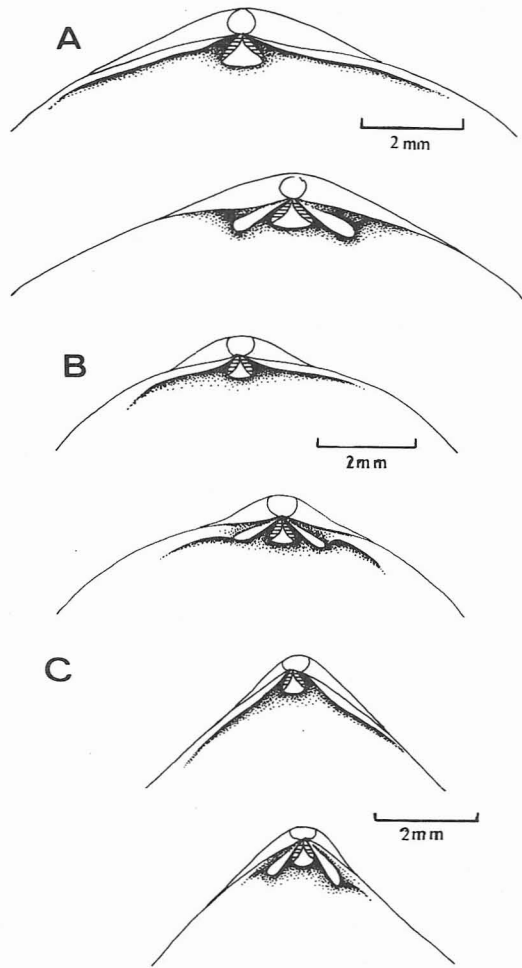


Fig. 14. A, *Myrella compacta*; B, *M. mutsuwanensis*; C, *M. triangularis*. The hinge plates; left above, right below.

Habitat. Subtidal corals, to intertidal rocks in protected waters.

Host. Nestling in coral crevices, also attached to the byssus of *Septifer virgatus* (Wiegmann, 1837), itself a coral related species (Dudgeon and Morton 1982). Morton (1980) discusses in detail the biology and functional morphology of this species.

Distribution. HONG KONG: New Territories, widely distributed throughout Tolo Harbour.

Remarks. Gould (1861) did not mention a specific locality for this species. As our Hong Kong material appears to represent the only specimens other than the type, we herein restrict the type locality to Hong Kong, New Territories, Tolo Harbour, Hoi Sing Wan (approximately 22° 26' N, 114° 15' E).

Myrella (Montacutona) mutsuwanensis
(Yamamoto and Habe, 1959)
(Plate Ii; Figure 14B)

Montacutona mutsuwanensis Yamamoto and Habe, 1959

Yamamoto and Habe 1959: 93, pl. 12, figs. 21, 22

Kuroda *et al.* 1971: 409E, pl. 120, fig. 1

Habe 1977: 146

Morton 1980: 433, pl. 1, fig. b

Montacutona tanakai Habe, 1959 (holotype NSMT 39871)

Habe 1959: 293, text figs. 3, 4

Habe 1977: 146

Morton 1980: 433, pl. 1, fig. e

Habe 1981: 100-101

Montacutona olivacea Habe, 1959 (holotype NSMT 39870)

Habe 1959: 294, text figs. 7-9

Habe 1977: 146, pl. 28, figs. 1, 2

Morton 1980: 192, pl. 1, fig. c, text fig. 5

Habe 1981: 100

Montacutona ceriantha Ponder, 1971 (holotype AMS 73540)

Ponder 1971b: 15-25, text figs. 1, 5-7

Morton 1980: 432, 434, 449

Holotype. NSMT 39855 (pair); off Ushirogata, Asamushi, Aomori Prefecture, Honshu, Japan.

Diagnosis. Shell to 7 mm in length, ovate, of medium thickness, compressed to moderately inflated, white to pale yellow-green; inequilateral, slightly longer anteriorly; beaks not prominent; prodissoconch small, 0.3 mm; sculpture of very faint growth striae; periostracum transparent, silky; all margins evenly rounded; teeth in right valve small, dorsal margin projections in the left valve are evident.

Comparison. This species differs from other *Mysella* (*s.l.*) in the evenly rounded, ovate, inequilateral shell which is slightly longer anteriorly.

Habitat. Subtidal sandy mud.

Host. Attached to the tube of the burrowing sea anemone *Cerianthus filiformis* Carlgreen (Cnidaria). The phoronid *Phoronis australis* Haswell, 1883 is also frequently found in the tube. Ponder (1971b) (as *M. ceriantha*) and Morton (1988) discuss the commensal relationship of this species with *Cerianthus* and *Phoronis*. Morton (1980) (as *M. olivacea*) reports on the biology and functional morphology of the species.

Distribution. HONG KONG: New Territories, Tolo Harbour, Hoi Sing Wan; AUSTRALIA: Queensland, Stradbroke Island, Dunwich (Ponder 1971b); JAPAN: Honshu and Kyushu (Habe 1981).

Remarks. The shell shape of this species and other shallow-water montacutids is variable. We can find no basis to separate the above listed synonymized species. Ponder (1971b) stated that *Montacutona ceriantha* 'differs from all of the Japanese species in details of the outline and strength of the hinge.' We have, however, found the high variability of specimens collected from a single burrow makes these distinctions questionable. The stoutness of the hinge varies with size, small specimens (as in the holotype of *M. mutsuwanensis*) have delicate teeth, whereas larger specimens (as in the holotype of *M. ceriantha*) have a more developed dentition. Until the Japanese species can be associated with a host, we can find no consistent feature to separate the species from each other and from the Australian species.

Subgenus unknown

Mysella triangularis (A. Adams, 1856)
(Plate Ij; Figure 14C)

Pythina triangularis A. Adams, 1856
A. Adams 1856: 47-48

Holotype. BMNH 1967997; 1 pair; Manila Bay, Luzon Island, Republic of the Philippines.

Diagnosis. Shell to 6 mm in length, trigonal, height nearly equal to length, moderately inflated; equilateral; beaks prominent, sharply pointed; prodissoconch medium, 0.4 mm; sculpture of fine growth lines; periostracum thickened, silky; dorsal margin sharply sloping on either side of beaks; ventral margin widely rounded in juveniles, straight with a central undulation and gape in larger specimens (type); two small cardinal teeth in right valve.

Comparison. *M. triangularis* is closest in outline to *Eolepton crassa* (Yokoyama, 1927) (lectotype UMUT CM24061), however the latter has a very thick shell, robust cardinal teeth in the right valve and distinct lateral teeth along the entire dorsal margin. The trigonal shape easily separates this species from all other Indo-West Pacific *Mysella*.

Habitat. Protected intertidal rocky shores.

Host. Collected from amongst aggregations of the bivalves *Barbatia virescens* (Reeve, 1844) and *Saccostrea cucullata*. Also collected from crevices of the commercial oyster *Crassostrea gigas* (Thunberg, 1793) in Hau Hoi Wan (Deep Bay). A single host has not been discovered.

Distribution. HONG KONG: New Territories; Tolo Harbour, Hoi Sing Wan; PEOPLE'S REPUBLIC OF CHINA: Guangdong Province, Hau Hoi Wan (Deep Bay); REPUBLIC OF THE PHILIPPINES: Luzon Island; Manila Bay.

Remarks. Placement of our Hong Kong specimens in this species is somewhat questionable. The holotype of *M. triangularis* is ventrally indented, creating a dorso-ventral (medial) suture on the outside of the shell. We believe this indentation may be due to a strong ventral byssal attachment. However in details of the hinge, beaks, and dorsal margin our specimens agree well with the type. It is possible that the type specimen represents an adult that has achieved permanent attachment thereby effecting the shell

outline, unlike the Hong Kong specimens which are much smaller juveniles.

Mysella triangularis is uncommon but probably widely distributed throughout Hong Kong.

Genus *Barrimysia* Iredale, 1929

Type species (original designation):

Rochefortia excellens Hedley, 1912

Hinge plate broad with two cardinal teeth in each valve; right valve with a distinct groove above each cardinal tooth and a small tooth or tubercle dorsal to the groove; ligament on a shallow resilifer projecting ventrally, directly below beaks.

Barrimysia siphonosomae

Morton and Scott sp. nov.

(Plate Ik; Figures, 15, 16)

Description. Shell to 8 mm in length, sub-trigonal, slightly inflated dorsally; inequilateral, slightly longer anteriorly; beaks pointed, prominent, often eroded, opisthogyrate; prodissoconch not visible; periostracum very thick and rough, light brown, silky, adherent; sculpture of fine concentric striae and occasional growth checks; hinge with one stout cardinal tooth on either side of beaks in each valve; a deep groove and a small lateral tubercle are present dorsal to each cardinal tooth in the right valve; ligament directly below beaks, seated on a stout resilifer; inner surface of shell lightly punctate inside of pallial line.

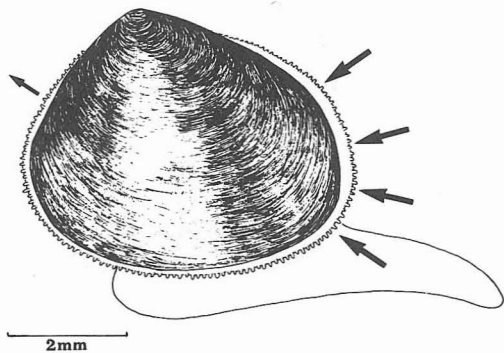


Fig. 15. *Barrimysia siphonosomae* sp. nov. The living animal as seen from the right side.

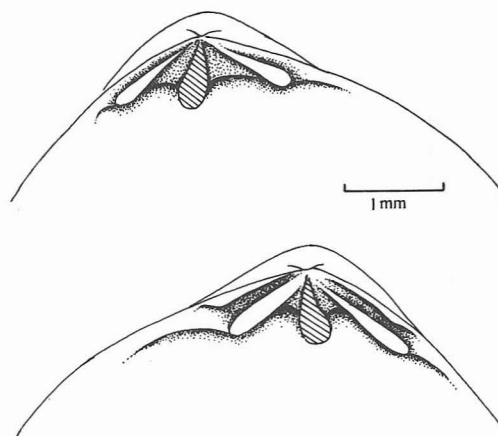


Fig. 16. *Barrimysia siphonosomae* sp. nov. The hinge plates; left above, right below.

Type locality. Hong Kong, Hong Kong Island, Tai Tam Bay; 21° 15' N, 114° 11' E; intertidal sandy mud flats in the burrows of *Siphonostoma cumanense*; collected by B. Morton and P.H. Scott, 13 October 1987.

Etymology. This species is named after the host sipunculan *Siphonostoma cumanense* (Keferstein, 1867).

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	BMNH 1989015	7.1	6.3
Paratypes	SBMNH 35073	6.5	5.6
		5.4	4.2
Paratypes	NSMT-Mo64702	7.1	5.7
		6.5	5.5
Paratypes	USNM 859387	5.9	5.1
		4.7	3.6
(plus two unmeasured paratypes BMNH 1988009)			

Comparison. The hinge of this species is close to *Barrimysia cumingii* (A. Adams, 1856) (syntype BMNH 1967996) and the type species *B. excellens* (Hedley, 1912) (not examined by authors). The prosogyrate beaks, elongate shape, and inner ventral radial crenulations of both

above species easily differentiate them from *B. siphonosomae*.

Barrimysia sagamiensis Kuroda and Habe in Kuroda *et al.* 1971 is thin shelled, subquadrate and inflated, compared to *B. siphonosomae* which is thick shelled, subtrigonal and only inflated dorsally.

The general shape of this species is similar to that of *Mysella triangularis*. The presence of stout teeth in each valve, however, separates *B. siphonosomae* from this species, and all other members of the Indo-West Pacific Montacutidae.

Habitat. Intertidal sandy mud flats.

Host. In the burrows of *Siphonoma cumanense* (Sipuncula). Manning and Morton (1987) (misidentified as *Nipponomysella subtruncata*) and Morton (1988) (as *Barrimysia* sp. nov.) discuss the commensal relationship of this species.

Distribution. Only known from type locality.

Genus *Curvemysella* Habe, 1959
Type species (original designation):
Pythina paula A. Adams, 1856

Shell distorted and variable in shape, generally an inverted V; equilateral; ventral margin greatly incurved; right valve with long lateral teeth.

Curvemysella is closely related to *Pythinella* Dall, 1899, the former being larger, with more central beaks, a greater incurved margin, and longer teeth in the right valve. With further study these two genera may be synonymized.

Curvemysella paula (A. Adams, 1856)
(Plate II; Figure 17)

Pythina paula A. Adams, 1856
A. Adams 1856: 47
Smith 1885: 203–204, pl. 12, fig. 1 a, b
[*Montacuta*]
Habe 1959: 294, text figs. 5, 6 [*Curvemysella*]
Habe 1967: 144, pl. 53, fig. 32 [*Curvemysella*]

Habe 1977: 148, pl. 27, figs. 10, 11 [*Curvemysella*]

Habe 1981: 103 [*Curvemysella*]

Pythina peculiarius A. Adams, 1856 (syntype BMNH 1987077)

A. Adams 1856: 47

Pythina arcuata A. Adams, 1856 (syntype BMNH 1967995)

A. Adams 1856: 47

Holotype. BMNH 1987076; 1 pair; Raine Island, Torres Strait, Queensland, Australia.

Diagnosis. Shell to 9 mm in length, inverted V shaped, inflated; equilateral; beaks prominent, prosogyrate; prodissoconch large, 0.5 mm; sculpture of irregular growth lines; periostracum thin to thick, tan to dark brown; ventral margin deeply curved inward; right valve with two long lateral teeth which thicken into small tubercles near beaks, left valve with a produced dorsal margin which fits into lateral teeth of the right valve; lithodesma thick, butterfly shaped.

Comparison. The unique shape of this species with a deeply incurved ventral margin cannot be confused with any other galeommatid in the Indo-West Pacific.

Habitat. Intertidal sands.

Host. Inside shells occupied by hermit crabs (Habe 1981), possibly *Diogenes edwardsii* in Hong Kong (B. Morton, personal observation).

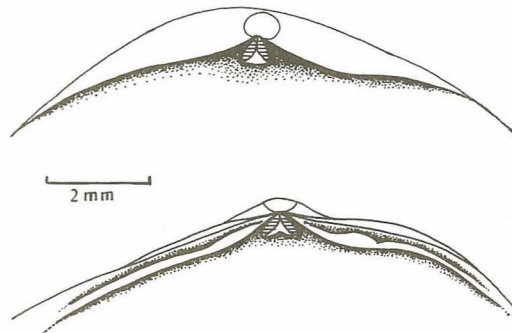


Fig. 17. *Curvemysella paula*. The hinge plates; left above, right below.

Distribution. HONG KONG: New Territories, Lantau Island, Tong Fuk; JAPAN: Honshu, Shikoku, and Kyushu (Habe 1981); AUSTRALIA: Queensland; Raine Island.

Remarks. The type of *Pythina arcuata* is a very interesting specimen with a transposed hinge, that is, the beaks are opisthogyrate and the hinge teeth are opposite those in the 'normal' *Curvemysella paula*. Cox (1969) documents this phenomenon for several bivalve families, but to our knowledge this is the first report in the Galeommatacea.

Specimens with ctenidial broods have been observed in Hong Kong.

Family Galeommatidae Gray, 1840

Genus *Scintilla* Deshayes, 185

Type species

(subsequent designation Stoliczka 1871):

Scintilla philippinensis Deshayes, 1856

Shell to 20 mm in length, thin to thick, inflated; hinge weak, left valve with two small teeth anterior of beaks and one posterior of beaks, right valve with a single anterior and posterior tooth; ligament transverse.

Deshayes (1856b) described 37 species of *Scintilla*, most from the Philippine Islands. A complete revision of the genus is necessary before one can confidently diagnose the Indo-Pacific species. As a revision of this magnitude is outside the scope of this paper, we have opted to use species which are closest in size, shape, and colour to the Hong Kong specimens.

Scintilla nitidella Habe 1962

(Plate Im; Figures 18, 19A)

Scintilla vitrea Habe, 1961

Habe 1961: 127, pl. 57, fig. 4
[non Quoy and Gaimard, 1856]

Scintilla nitidella Habe, 1962

Habe 1962: 46, pl. 57, fig. 4
Habe 1968: 185, pl. 57, fig. 4
Kuroda *et al.* 1971: 411(E), pl. 120, fig. 7
Habe 1977: 152, pl. 27, figs. 14, 15
Habe 1981: 105

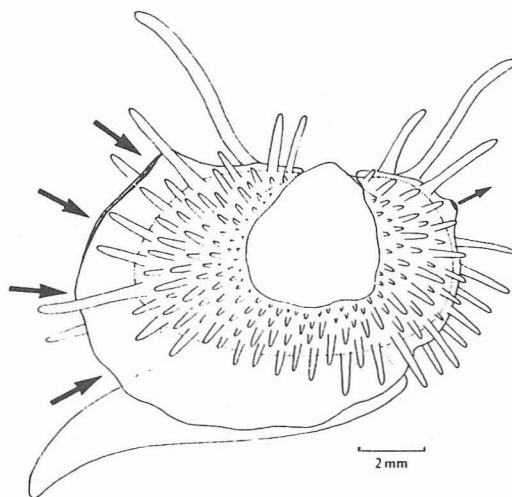


Fig. 18. *Scintilla nitidella*. The living animal as seen from the left side.

Holotype. NSMT 49829 (1 pair); Tsubaki Hot Spring, Wakayama Prefecture, Japan.

Diagnosis. Shell to 13 mm, subquadrate to subovate, semi-transparent, white to pale bronze; inequilateral, slightly longer posteriorly; beaks small and pointed; prodissoconch small, 0.3 mm; periostracum thin, with a high gloss; dorsal margin straight on either side of beaks; posterior margin slightly drawn out; hinge plate and teeth well defined for genus.

Comparison. The straight dorsal margin, pointed beaks, relatively strong dentition, and light bronze colour (Hong Kong specimens only) differentiate this species from *S. cf. opalinus* and *S. cf. cuvieri*.

Habitat. Subtidal corals.

Host. Occupies coral galleries in association with a range of other invertebrates including ophiuroids and alpheid shrimps (Morton *et al.* in prep.). Dudgeon and Morton (1982) discuss the distribution of this species (misidentified as *Paraborniola matsumotoi*) within coral galleries in Tolo Harbour, Hong Kong.

Distribution. HONG KONG: New Territories, throughout Tolo Harbour; JAPAN: Honshu (Sagami Bay to Kii Peninsula) (Habe 1981).

Scintilla cf. *opalinus* Kuroda & Habe 1971
(Plate In; Figure 19B)

Scintillorbis opalinus Kuroda and Habe, 1971
Kuroda and Habe 1971: 412(E), pl. 120,
figs. 9, 10
Habe 1977: 152 [*Sagamiscintilla*]

Holotype. In the collection of His Majesty the Emperor of Japan (1 pair) (not examined by authors).

Diagnosis. Shell to 13 mm in length, thin, inflated, milky white to pale pink; outline variable, ovate to subquadrate but generally with a flared

posterior margin; inequilateral, longer posteriorly; beaks prosogyrate; prodissoconch small, 0.2 mm; periostracum transparent, shiny; hinge medium to obscure.

Comparison. This species is quite variable in shape. The slightly flared posterior margin and milky white to pale pink colour assist in separating it from other *Scintilla* species in Hong Kong.

Habitat. Intertidal sandy mudflats, under stones.

Host. Specific host unknown, but the species is probably commensal with an alpheid shrimp.

Distribution. HONG KONG: Hong Kong Island, Tai Tam Bay; JAPAN: Honshu, Sagami Bay (Kuroda and Habe 1971).

Remarks. Habe (1975) places this species into *Sagamiscintilla* (new name for *Scintillorbis* Kuroda and Habe, 1971 *non* Dall, 1899). We can find no consistent characters which separate this genus from *Scintilla*.

Scintilla cf. *cuvieri* Deshayes, 1856
(Plate Io; Figure 19C)

Scintilla cuvieri Deshayes, 1856.
Deshayes 1856b: 174

Lectotype (herein). BMNH 196761/1; 1 pair; length = 18.6 mm, height = 14.3 mm (small hole in right valve).

Type locality. Republic of the Philippines, Bohol Island, Balclayon; approximately 09° 45' N, 124° 15' E.

Diagnosis. Shell to 19 mm, subquadrate, thick to thin, inflated, bronze to bright yellow; beaks broad; prodissoconch small, 0.3 mm; posterior broadly flared, anterior constricted and truncate; hinge weak, teeth often only visible under high magnification.

Comparison. The broad beaks, thick shell, and

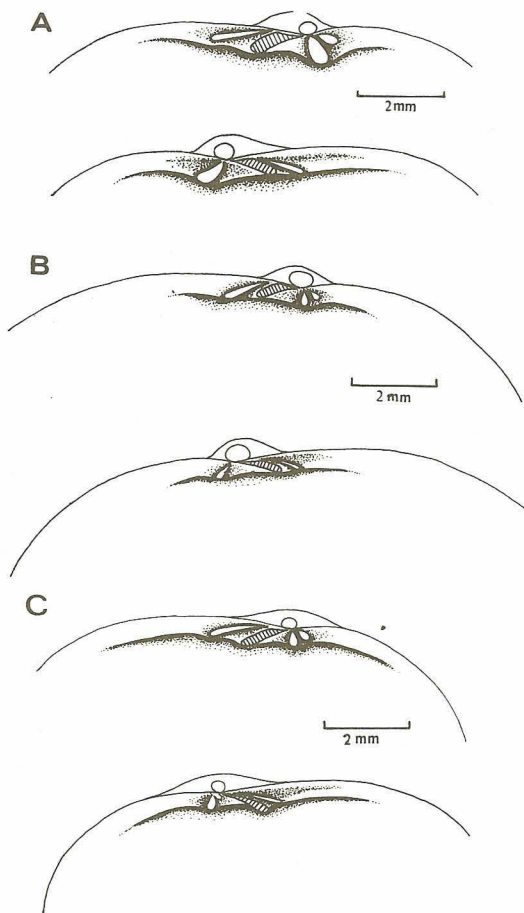


Fig. 19. A, *Scintilla nitidella*; B, *Scintilla* cf. *opalinus*; C, *Scintilla* cf. *cuvieri*. The hinge plates; left above, right below.

weak hinge of Hong Kong specimens separate this from other *Scintilla* in the region.

Habitat. Subtidal coral reefs.

Host. Occupies coral galleries in association with a range of other invertebrates including ophiuroids and alpheid shrimps (Morton *et al.* in prep.). Dudgeon and Morton (1982) discuss the distribution of this species within coral galleries (misidentified as *Scintilla nitidella*) in Tolo Harbour.

Distribution. HONG KONG: New Territories, throughout Tolo Harbour; REPUBLIC OF THE PHILIPPINES: Bohol Island.

Remarks. The lectotype is probably the specimen figured by Sowerby (1874) in Reeve *Conchologica Iconica*, volume 19, plate 2, figures 15a and 15b.

Genus *Scintillona* Finlay, 1927
Type species (original designation):
Spaniorinus zealandicus Odhner, 1924

Shell with rounded anterior and posterior margin; equilateral; beaks prominent; a small tooth anterior of beaks in each valve; ligament slightly posterior of beaks.

Scintillona brissae Morton and Scott sp. nov.
(Plates Ip, Iic; Figure 20)

Description. Shell to 7 mm length, subtrigonal, thin, inflated; equilateral; beaks prominent, broadly rounded, prosogyrate; prodissoconch small, 0.3 mm; sculpture of concentric growth striae and faint radial striae; periostracum thin, silky, iridescent, adherent; dorsal margin gently sloping on both sides of beaks to broadly rounded anterior and posterior margins, ventral margin evenly rounded; hinge minute, with a small tooth below beaks in each valve; ligament seated on a resilifer posterior of beaks.

Type locality. Hong Kong, New Territories, Tolo Channel; 22° 29' N, 114° 19' E; subtidal mud; attached to the spines near the anus of *Brissus*

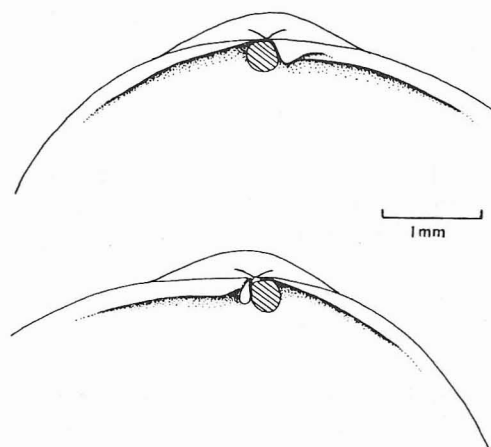


Fig. 20. *Scintillona brissae* sp. nov. The hinge plate; left above, right below.

latecarinatus; collected by B. Morton, April 1983.

Etymology. This species is named after the host, *Brissus latecarinatus* (Leske).

Deposition and measurements (in mm) of type specimens

	Institution	Length	Height
Holotype	SBMNH 35074	5.6	4.3
Paratype	SBMNH 35075	3.2	2.2
Paratype	NSMT-Mo64701	6.6	4.8
Paratype	USNM 859386	5.7	4.0

(plus unmeasured paratype BMNH 1988014)

Comparison. This species is closest to *Scintillona stigmatica* (Pilsbry, 1921) (lectotype ANSP 116101) described from Hawaii and reported from Japan (Yamamoto and Habe 1974), that is also commensal on *Brissus latecarinatus*. However *S. stigmatica* is inequilateral, with a constricted anterior margin and a distinctive brown stripe from the beaks to the ventral margin. *Scintillona brissae* is also similar to *Scintillona bellerophon* O'Foighil and Gibson, 1984 (holotype RBCM 983-1617-1), although this eastern Pacific species has a straight anterodorsal margin, and is associated with the burrowing holothurian *Leptosynapta clarki* Heding, 1928. Both *S. stigmatica* and *S. bellerophon*

lack the faint radial striae that are present in *Scintillona brissae*.

Habitat. Subtidal, sandy mud.

Host. Attached to the spines near the anus of the burrowing heart urchin, *Brissus latecarinatus* (Echinoidea) (Plate IIc).

Distribution. HONG KONG: New Territories, Tolo Channel.

Remarks. The inflation of the shell and general external appearance is not unlike *Scintilla*. However, the single tooth in each valve separates *Scintillona brissae* from any *Scintilla* species.

Genus *Galeomma* Turton, 1825

Type species (subsequent designation Gray 1847):

Galeomma turtoni Turton, 1825

Shell thin, transparent with large ventral gape; sculpture of weak radial striae and punctations; interior shiny; live animal with mantle reflected over shell.

As with *Scintilla*, Deshayes (1856a) described numerous new species of *Galeomma* from the Indo Pacific. A separate treatment will be necessary to fully review and revise the Asian members of this genus. We have used appropriate names which are still in common use in the literature.

Galeomma takii Kuroda, 1945
(Plate Iq; Figures 21, 22A)

Galeomma (Paralepida) takii Kuroda, 1945

Kuroda 1945: 39, pl. 2, figs. 9–12

Habe 1961: 126, pl. 57, fig. 12

Habe 1967: 144, pl. 53, fig. 31 [*Paralepida*]

Habe 1968: 185, pl. 57, fig. 12 [*Paralepida*]

Morton 1973: 133–150, pl. 1, text figs. 1–9

Habe 1977: 149, pl. 27, fig. 12 [*Lepirodes*]

Habe 1981: 104, pl. 12, fig. 4 [*Lepirodes*]

Holotype. Not located, possibly not extant.

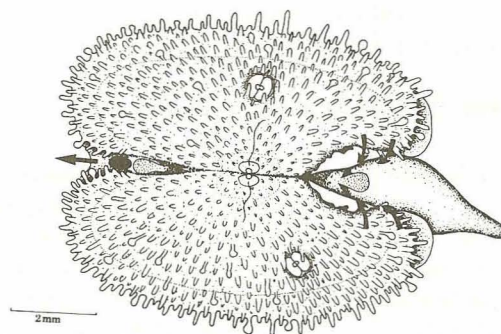


Fig. 21. *Galeomma takii*. A dorsal view of the living animal (after Morton, 1973).

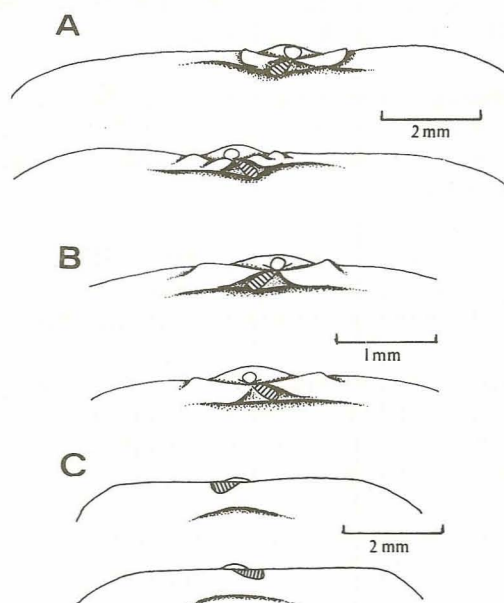


Fig. 22. A, *Galeomma takii*; B, *G. polita*; C, *Ehippodonta oedipus*. The hinge plates; left above, right below.

Diagnosis. Shell to 15 mm in length, white to orange; inequilateral, slightly longer posteriorly; beaks prosogyrate, small, pointed; prodissoconch small, 0.3 mm; sculpture of fine concentric and radial striae, and small pustules; periostracum not evident; hinge weak; right valve with two very small teeth on either side of beaks; left valve with one tooth on either side of beaks which interlocks with the teeth in the right valve.

Comparison. This species has a variable hinge with the teeth obscure in some specimens (especially juveniles) and more robust in others (see Morton 1973). In general, however, *G. takii* has a more developed hinge than *G. polita* (Deshayes, 1856a). In addition, *G. takii* has an external sculpture with many pustules whereas *G. polita* has numerous surface punctations. Living animals are easily separable: *G. polita* has large siphonal tentacles (Morton 1975), whereas those of *G. takii* are reduced.

Habitat. Under intertidal rocks on sandy mud and rubble.

Host. Host unknown, but possibly associated with an alpheid shrimp. Morton (1973) discusses the biology and functional morphology of this species.

Distribution. HONG KONG: Tolo Harbour at Hoi Sing Wan and Ting Kok; Tai Tam Bay; JAPAN: Honshu, Shikoku, Kyushu (Habe 1981)

Galeomma polita Deshayes, 1856
(Plate 1r ; Figures 22B, 23)

Galeomma polita Deshayes, 1856

Deshayes 1856a: 169

Morton 1975: 365–369

Solecardia vitrea japonica Pilsbry, 1904

(syntypes ANSP 86276)

Pilsbry 1904: 558–559, pl. 41, fig. 6

Lectotype (herein). BMNH 196750; 1 pair; length = 11.5 mm, height = 6.5 mm (specimen with chipped edges).

Type locality. Republic of the Philippines, Samar Island; approximately 12° 0' N, 124° 30' E.

Diagnosis. Shell to 8 mm in length, thin, transparent, white to deep orange; inequilateral, posterior slightly longer; beaks small, prosogyrate, pointed; prodissoconch small, 0.3 mm; sculpture of fine irregular growth striae, very fine radial striae, numerous punctations; hinge reduced with a single tubercle on either side of beaks in each valve.

Comparison. See comparison section for *Galeomma takii*.

Habitat. Intertidal, under rocks on sandy mud and rubble.

Host. Host unknown, but possibly with an alpheid shrimp. Morton (1975) discusses aspects of the biology of this species.

Distribution. HONG KONG: Tolo Harbour at Hoi Sing Wan; REPUBLIC OF THE PHILIPPINES: Samar Island.

Remarks. The outline of the shell and beaks of Hong Kong specimens are identical to the lectotype of *Galeomma polita*. Hong Kong shells are, however, slightly thicker and have more pronounced radial striae.

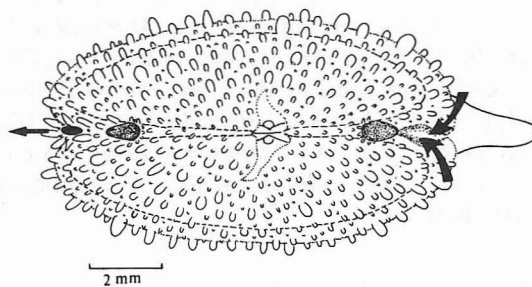


Fig. 23. *Galeomma polita*. A dorsal view of the living animal.

Genus *Ehippodonta* Tate, 1889

Type species

(subsequent designation Mitchell 1890):

Scintilla? lunata Tate, 1887

Shell elliptical, thin, white, transparent with heavy external sculpture; dorsal margin straight; with large ventral gape.

Ehippodonta oedipus Morton, 1976

(Plate 1s; Figure 22C)

Ehippodonta (Ehippodontina) oedipus

Morton, 1976

Morton 1976: 31–39, pl. 3, text figs. 1–5

Holotype. BMNH 197542/1; west coast of Chek Chau Island, Mirs Bay, Hong Kong.

Diagnosis. Shell to 12 mm, thin, transparent, ellipsoid, with straight dorsal margin; equilateral; beaks small; prodissoconch medium, 0.4 mm; sculpture heavy, reticulate, giving a beaded appearance at the intersection of the concentric and radial lines; no cardinal teeth present, but most specimens are laterally thickened along the dorsal margin on either side of beaks of both valves.

Comparison. The living animal differs from *E. murakamii* Kuroda, 1945, which apparently does not possess a reflected mantle covering the shell (Arakawa 1960). *E. murakamii* is also described as having a cardinal tooth (Arakawa 1960).

Habitat. Subtidal corals.

Host. Coral galleries, definitively associated with a number of co-occurring partners (Morton *et al.* in prep.) notable among which is *Macrophiothix variabilis* (Duncan) (Ophiuroidea), *Alpheus edwardsii* (Audouin) and *A. hippothoe* De Man (Alpheidae), *Galathea orientalis* Stimpson (Galatheididae), *Stenopus hispidus* (Oliver) (Stenopodidae), and *Hololepidella nigropunctata* (Annelida).

Distribution. HONG KONG: Chek Chau Island, Mirs Bay. Dudgeon and Morton (1982) discuss the distribution of this species in Tolo Harbour.

Remarks. Morton (1976) includes discussions of the anatomy, morphology, and biology of this species.

Genus *Entovalva* Voeltzkow, 1890

Type species (monotypy):

Entovalva mirabilis Voeltzkow 1890

Shell thin, subtrigonal to subquadrate; shell completely covered by a thick, smooth, non-retractable mantle; very inequilateral, longer posteriorly; beaks prominent, prosogyrate; hinge weak.

Familial status of this rare genus is uncertain. Chavan (1969) places *Entovalva* in the Mon-

tacutidae. We consider the completely reflected mantle aligns it closer with the Galeommatidae.

Entovalva differs from *Devonia* Winckworth, 1930 by the completely internal shell and the non-retractable mantle of the former.

Entovalva semperi Ohshima, 1930
(Plate IId; Figure 24)

Entovalva semperi Ohshimai, 1930
Ohshima 1930: 25–27, pl. 2, figs. 1–4
Ohshima 1931: 161–77, pl. 5, figs. 1–5,
pl. 6, figs. 6–12
Habe 1977: 153 [*Devonia*]
Xu 1986: 31 [*Devonia*]

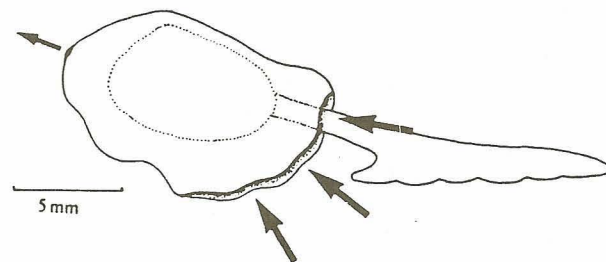


Fig. 24. *Entovalva semperi*. The living animal as seen from the right side.

Holotype. Not located, possibly not extant.

Diagnosis. Shell to 8 mm in length (body to 10 mm), very reduced, thin; valves joined only at the beaks by a large ligament; all margins gaping; hinge weak with a single minute tooth anterior of the beaks in each valve; animal with a large flattened foot used as a sucker to attach to the host.

Comparison. The reduced gaping shell, which is covered by the fleshy, smooth mantle, separates this from all other galeommatids in the region.

Habitat. Subtidal offshore muds, about 5–10 m.

Host. Attached to the body wall of the holothurian *Protankyra bidentata* (Woodward and Barrett) (Ohshima 1930; 1931). We have not directly observed the association between *E. semperi* and *Prototankyra bidentata* as our samples were collected by an infaunal grab. The presence of both species in a single sample is, however, highly suggestive that the host in Hong Kong is the same as that reported upon from Japan.

Distribution. HONG KONG: Tap Shek Kok; JAPAN: Tomioka, Amakusa, Kyushu; possibly the Philippine Islands (Ohshima 1930).

Remarks. Ohshima (1930) separates *E. semperi* from *E. mirabilis* by 'the shape of the foot and mode of living' and from *E. perrieri* (Malard, 1904) by 'the entirely internal valves and in absence of papillae on the mantle, and of byssal papilla.'

Discussion

The Hong Kong Galeommatacea are a diverse group with every constituent family, save the Leptonidae, and nine genera represented. In a limited depth zone, from intertidal to about 25 m, 22 species have been shown to exploit a wide range of habitats, although most appear restricted to protected substrates, including rocks, corals, and sandy mud flats. Hong Kong species are described and discussed in the appropriate sections of this paper, and Table 1 sets out a general scheme of habitat/host preferences.

Four species, including the cosmopolitan *Lasaea rubra* (Ponder 1971a), do not appear to be associated with any particular species but rather occur in large aggregations, such as in the crevices of intertidal rocks or in coral galleries. Of this category only *Mysella compacta* has been studied in any detail (Morton 1980). A second group of nine species is more specifically associated with a particular community which in some cases is reasonably well defined, e.g., *Pseudopythina ochetostomae* with the *Ochetostoma erythrogrammon* community (Morton

1988). In most other cases, however, the exact relationships between commensal and the host community is less clearly understood, as for example with *P. maipoensis*, *P. ariakensis* and the species of *Galeomma*. Only recently have the coral associated species been allocated host communities (Morton *et al.* in prep.). A final category of nine species have specific hosts to which they have a high degree of dependence, and specific adaptations that suit them to life in intimate association with a larger host.

Boss (1965) hypothesized that as more data were gathered, the notion of host specificity might prove to be false. He used as an example the well studied *Mysella bidentata* (Montagu, 1803), which associates with a variety of invertebrate taxa including sipunculans, annelids, and echinoderms. *Mysella tumida* (Carpenter, 1864), an eastern Pacific species, is also a generalist, having been observed in the burrows of polychaetes and holothurians (O'Foighil 1985). Morton (1972) concurred with the generalist hypothesis, reporting *Pseudopythina subsinuata* in association with four species of stomatopods in Hong Kong, but most often with *Oratosquilla oratoria*. Some Hong Kong species have general host requirements, but we have also found that many species appear to be highly host specific. Thus, *Pseudopythina nodosa* and *Barrimysia siphonosomae* are specific of their host sipunculans but, more than this, are both excluded when their host's burrows are occupied by similarly host specific pinnotherid crabs (Manning and Morton 1987).

In Hong Kong, *Scintillona brissae* has been collected attached only to *Brissus latecarinatus* (Echinoidea) and indeed is restricted to the anal spines of this species. From Japan (Habe 1981) and Hawaii (Dall *et al.* 1938), *S. stigmatica* is also recorded as commensal on *B. latecarinatus*. *Mysella* (*Montacutona*) *mutsuwanensis* [= *Montacutona ceriantha* Ponder, and *Montacutona olivacea* Habe] has a specific association with *Cerianthus filiformis* (Cnidaria) in Hong Kong (Morton 1980; 1988) and Australia (Ponder 1971b). The species has not been collected alive in Japan, and the host association is unknown although it is likely to be the same. The documentation of host relationships is in many cases

Table 1. Hong Kong galeommataceans divided into categories of habitat/host specializations.

	Habitat/Host	Reference
Generalist species		
Lasaeidae		
<i>Lasaea rubra</i>	intertidal rocky shores	Tebble 1966
Kelliidae		
<i>Kellia porculus</i>	low intertidal/subtidal rocks	Kuroda <i>et al.</i> 1971
<i>Pseudopythina subsinuata</i>	several species of stomatopods	Morton 1972
Montacutidae		
<i>Mysella compacta</i>	intertidal/rocks/subtidal coral crevices	Morton 1980
<i>Mysella triangularis</i>	intertidal rock crevices	this study
Community associates		
Kelliidae		
<i>Pseudopythina ariakensis</i>	<i>Protankyra bidentata</i> community	Morton 1988
<i>Pseudopythina tsurumaru</i>	<i>Protankyra bidentata</i> community	Morton 1988
<i>Pseudopythina ochetostomae</i>	<i>Ochetostoma erythrogrammon</i> community	Morton 1988
<i>Pseudopythina maipoensis</i>	burrows of mud dwelling tanaids and polychaetes	this study
Galeommatidae		
<i>Scintilla nitidella</i>	coral gallery community	Morton <i>et al.</i> in prep.
<i>Scintilla cf. cuvieri</i>	coral gallery community	Morton <i>et al.</i> in prep.
<i>Galeomma takii</i>	under-stone community	Morton 1973
<i>Galeomma polita</i>	under-stone community	Morton 1975
<i>Ephippodonta oedipus</i>	coral gallery community	Morton 1976
Specific associates		
Kelliidae		
<i>Pseudopythina nodosa</i>	<i>Sipunculus nudus</i>	Manning and Morton 1987 as (<i>Fronsella ohshimai</i>) this study
<i>Pseudopythina macrophthalmensis</i>	<i>Macrophthalmus latreille</i>	this study
Montacutidae		
<i>Mysella mutsuwanensis</i>	<i>Cerianthus filiformis</i>	Ponder 1971b; Morton 1980
<i>Barrimysia siphonosomae</i>	<i>Siphonosoma cumanense</i>	Manning and Morton 1987 as (<i>Nipponomysella subtruncata</i>) Habe 1981
<i>Curvemysella paula</i>	hermit crabs	
Galeommatidae		
<i>Scintilla cf. opalinus</i>	unknown alpheid shrimp	this study
<i>Scintillona brissae</i>	<i>Brissus latecarinatus</i>	this study
<i>Entovalva semperi</i>	<i>Protankyra bidentata</i>	Ohshima 1930; 1931

crucial to an understanding of taxonomy and the variability in shell form of each species. Observing specimens of *Mysella mutsuwanensis* collected with a single host has demonstrated this and led to the proposed synonymization of four species. As more host information becomes available, it is probable that more species in the Indo-West Pacific will be synonymized.

It must be noted, however, that correct associative host identification is crucial. We have found inconsistencies in reported hosts for several species that might actually reflect incorrect identifications (either host or commensal), or confusion in determining the correct host burrow. In Hong Kong, *Ochetostoma erythrogrammon*, *Siphonosoma cumanense* and *Sipunculus*

nudus occur on the same shores, and one must use extreme care in determining from which host burrow a particular commensal has been collected. Habe (1981) records *Pseudopythina ohshimai* from *Sipunculus nudus* in Japan, and *P. philippinensis* also from *S. nudus* in the Philippines, whereas Nielsen (1976) records a *Mysella* sp. (probably a species of *Pseudopythina*) from *Siphonosoma cumanense* in Thailand. In Hong Kong, *Pseudopythina nodosa* is recorded from *Sipunculus nudus*. Such discrepancies might reflect: (i), inconsistent commensal identification (although clearly *P. ohshimai*, *P. philippinensis* and *P. nodosa* are different); (ii), inconsistent host identification; (iii), differential host specificity by either a single or a number of commensals of the same genus; or (iv), a mixture of these sources of confusion.

The associative hosts of representatives of the Galeommataceae pose a difficult problem. Hong Kong species have been documented with coral and alpheid shrimp assemblages. The specific or general host requirements of local species of *Galeomma* are, as elsewhere, still unclear. For species of coral associated *Scintilla* and *Ephippodonta oedipus*, however, Morton *et al.* (in prep.) has observed definable relationships with other members of the coral gallery community. Each species appears to be responding to and associating with a particular micro-community provided by the coral or rock habitat. In the case of *E. oedipus*, *Macrophiothrix variabilis* (Ophiuroidea), two species of Alpheidae, and three other associates seem to constitute the optimal habitat. Such communities are unlikely to be stable and consistent over space and time and it is thus probable that potential community interactions are more dynamic than is presently realized (Morton *et al.* in prep.).

It thus appears from the data obtained for this guild of bivalves in Hong Kong that there are, almost certainly, such species as *Lasaea rubra*, *Mysella triangularis* and *M. compacta* that are generalist crevice dwellers. Others are in more general association with a micro-community, as with many galeommataceids and scintillids. Some, such as *Pseudopythina subsinuata* with a range of stomatopod hosts, may occur with various

representatives of the same taxonomic group, while others are highly specific, *e.g.*, *Scintillona brissae*, *Mysella mutsuwanensis*, *Pseudopythina ochetostomae* and *Entovalva semperi*. These highly variable degrees of host specificity in the small geographic range of Hong Kong suggests that this picture may be globally true and that the extent of host specificity can be regarded as the degree to which adaptive radiation of each family has progressed. Assessment of the host specificity of constituent species of the Galeommataceae thus remains an important task that will, when undertaken, provide a clearer picture of what is at present a confused taxonomy at many levels.

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